

JPRS 70125

9 November 1977

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 408

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BIBLIOGRAPHIC DATA SHEET	1. Report No.	JPRS 70125	2.	3. Recipient's Accession No.
	4. Title and Subtitle USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - GEOPHYSICS, ASTRONOMY AND SPACE, No. 408			5. Report Date 9 November 1977
7. Author(s)			6.	8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No.	
			11. Contract/Grant No.	
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered	
			14.	
15. Supplementary Notes				
16. Abstracts The report contains abstracts and news items on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial physics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included.				
17. Key Words and Document Analysis. 17a. Descriptors USSR Geophysics Astronomy Astronautics Meteorology Oceanography				
17b. Identifiers/Open-Ended Terms				
17c. COSATI Field/Group 3, 4A, 4B, 8, 22				
18. Availability Statement Unlimited Availability Sold by NTIS Springfield, Virginia 22151			19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 49
			20. Security Class (This Page) UNCLASSIFIED	22. Price PCA03

9 November 1977

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS
GEOPHYSICS, ASTRONOMY AND SPACE

No. 408

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. ASTRONOMY

Abstracts of Scientific Articles

STATIONARY POINTS OF FIELDS OF ATTRACTION OF MOON AND PLANETS

Moscow ASTRONOMICHESKIY ZHURNAL in Russian Vol 54, No 4, 1977 pp 909-914

[Article by S. G. Zhuravlev, "Stationary Points of Gravitational Fields of the Earth, the Moon and Mars"]

[Abstract] The objective of this study was computation of the coordinates of stationary points in the gravitational fields of the Earth, the Moon and Mars, determination of the number of harmonics which must be retained for the precise computation of the coordinates of stationary points and investigation of the nature of stationary points. The stationary points of the gravitational fields of Earth and Mars are situated deep within the sphere of action of the planets, whereas the stationary points of the lunar gravitational field are situated outside its sphere of action. The closeness of the stationary points of the gravitational fields of Earth and Mars determines the appreciable influence of the figure of the planet on the longitudes of the stationary points. For example, third-order harmonics cause a displacement of the stationary points relative to the positions determined for triaxial planets by about 3° . This indicates that in computations of the orbits of stationary objects for the Earth and Mars it is necessary to take into account harmonics of a higher order. For stationary points on the Moon, due to their considerable distance from the center, the influence of its figure is insignificant and second- and third-order harmonics are adequate for a reliable determination of the coordinates of the stationary points. The stationary points of all the considered bodies lie virtually in their equatorial planes. The influence of the considered bodies on the distance of the stationary points from their center is insignificant. Thus, harmonics of the second order and above cause a displacement of the stationary points along the radius vector not exceeding 50 m for the Earth and Mars and 100 m for the Moon.

[49]

RADIOSPECTROSCOPY OF PLANETARY ATMOSPHERES FROM SPACE PROBES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 943-948

[Article by A. P. Naumov, Scientific Research Radiophysics Institute,
"Theoretical Investigation of the Possibilities of Radiospectroscopy of
Planetary Atmospheres from Automatic Interplanetary Stations"]

[Abstract] The author has investigated the possibilities of remote determination of a number of admixture components in the upper atmosphere of Venus and also the content of ammonia and water vapor in the atmospheres of Jupiter and Saturn by means of radio probing in the resonance regions of the corresponding gases. It was possible to establish the possible limits of determination of the relative concentration of these gases. From a comparison of the minimum detectable concentrations of the gas components with the results of spectroscopic investigations in the IR range and with the upper limits computed from equilibrium conditions for the components it was possible to determine the effective conditions for use of the considered method. It is suggested that SHF probing of planetary atmospheres be carried out for a quantitative determination of the chemical composition of the subcloud parts of the atmosphere. However, solution of this problem requires additional physical information on the characteristics of the cloud covers of planets. But by carrying out appropriate radiometric measurements at a number of wavelengths one can hope to obtain extremely useful information on cloud formations.

[53]

EQUILIBRIUM TEMPERATURE PROFILE IN VENUSIAN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 936-942

[Article by A. S. Ginzburg and A. S. Safray, Institute of Atmospheric Physics, "Radiation Fluxes and Equilibrium Temperature Profile in the Venusian Atmosphere"]

[Abstract] The authors have proposed a simple method for computing the effective flux of thermal radiation in the subcloud atmosphere of Venus. It is based on the use of the diffusion approximation and Rosseland's mean. It is shown how it is possible to construct the equilibrium temperature profile. The influence of the relative content of water vapor and clouds on the heat regime is discussed. The data presented here, together with expression (14), make it possible to construct the radiative equilibrium profiles for both the cloud and subcloud layers with different H₂O contents. The results show that a purely carbon dioxide atmosphere cannot

due to the greenhouse effect create the observed surface temperature and atmospheric temperature gradient. It is easily shown that the lower layer (0-13 km) is unstable regardless of the water vapor content. The stability of the equilibrium profile in the next layer (13-25 km) is essentially dependent on the H_2O concentration but the subcloud layers have a subadiabatic equilibrium temperature gradient. Therefore, it is necessary to postulate the presence of convective mixing in order to explain the observed virtually adiabatic temperature profile in the entire subcloud layer of the atmosphere.

[53]

II. METEOROLOGY

News

JOINT EFFORTS IN LONG-RANGE WEATHER FORECASTING

Tallin SOVETSKAYA ESTONIYA in Russian 10 Aug 77 p 3

[Article by S. Buranov, "Weather Forecasting: Today and Tomorrow"]

[Abstract] An Australian meteorologist from Melbourne recently arrived in the USSR for an extending stay as part of the general program of cooperation in meteorological research between the USSR and other countries. The Australian specialist will visit for six months to study the work of Soviet scientists on mathematical modeling in meteorology. Russian experts have developed the special "mean values" method which will make it possible to introduce into an electronic computer more complex tasks with a great volume of information without increasing the time required for its processing. As a result, in their forecasts scientists are able to take into account a great volume of data on atmospheric phenomena. In particular, this method is used at the Akademgorodok Computation Center where the Australian visitor will spend several months. At the Computation Center specialists have developed a mathematical model of general circulation of the atmosphere and ocean intended for long-range weather forecasting. The investigations of Soviet meteorologists have shown that the new method can make it possible to predict weather for up to a season in advance. Academician Guriy Marchuk, Chairman of the Siberian Department USSR Academy of Sciences, a well-known specialist in the field of mathematical modeling, assigns great importance to solution of the problem of meteorological forecasting. In his opinion, however, the numerical models now developed in the Soviet Union have been brought up to such a level that any improvement in the computation process no longer will lead to any improvement in forecasting. Academician Marchuk feels that the principal direction now should be an improvement in meteorological information used as initial data. Until now there has been a considerable shortage of aerological data on the world ocean. For solution of this problem Academician Marchuk feels that during the next five to ten years it is necessary to carry out a series of global meteorological observation programs using satellite systems. Already in 1978, in conformity to a decision of the WMO, a major program is to be

carried out for investigating the atmosphere on a planetary scale. The USSR is taking an active part in this program. Its implementation should yield data which will help in checking existing models of general circulation of the atmosphere. Specialists at the Institute of Physics of the Atmosphere during October-November of last year took part in an international experiment for comparing meteorological instruments which was held in Australia. Working 300 km to the north of Melbourne, specialists found the steppe relief of that region favorable for measurements of turbulent phenomena in the atmosphere. The visit of the Australian meteorologist still further strengthens the bonds between Australia and the USSR in the field of meteorological cooperation.

[44]

PETROSYANETS ON SOVIET PREPARATIONS FOR INTERNATIONAL GLOBAL EXPERIMENT

Moscow PRAVDA in Russian 17 Oct 77 p 4

[Article by V. Molchanov: "Towards the Secrets of the Weather"; interview with M. A. Petrosyanets, Director of the USSR Hydrometeorological Center]

[Text] Soviet professional meteorologists are making preparations for the First International Global Experiment which will begin in the coming year. A PRAVDA correspondent discussed this with M. A. Petrosyanets, Director of the USSR Hydrometeorological Center.

Q: First about the factors dictating the necessity of such an experiment.

A: In the morning, opening the newspaper, the reader can read a communication as to what today's weather is and what it will be for the next day: rain or sun, heat or cold. A few short lines. But behind them stands the careful work of weathermen, the achievements of a whole series of sciences -- hydromechanics and atmospheric physics, mathematics and cybernetics.

Within the framework of the world weather service there is a global system of observations. In most countries there is a network of ground synoptic stations. Eight times a day they provide "photographs" of the weather. The vertical sounding stations twice a day probe the atmosphere and report on the velocity and direction of the air currents, temperature and humidity in its entire thickness. Now 10,000 synoptic and about 800 sounding stations are operating on the planet. The scientific research ships of the USSR and other countries are making continuous observations at four points in the Atlantic and at one point in the Pacific Ocean. At the same time about 2,000 commercial ships and more than 1,500 passenger aircraft are transmitting data on the state of the atmosphere along their routes.

But the registry of conditions is only half the job. The results of observations must be communicated to special centers where the information is analyzed and used in preparing forecasts. A global communication system has been created for this purpose; it connects world, regional and national meteorological centers for the processing of data. The World Centers are located in Moscow, Washington and Melbourne.

The volume of information arriving here seemingly is doubling. Information on the weather and air currents lies on the weatherman's table in the form of maps with symbols. On this basis the specialist makes a "diagnosis" of the state of the atmosphere over the northern and southern hemispheres, in the tropical zone. At the same time this information is directed through communication channels to electronic computers. They carry out computations of the future state of the atmosphere. The results of the numerical forecast are also sent to weathermen. These are used to determine how the weather will look in the near future. A rather precise numerical forecast is now prepared for one to five days. It is not always justified for longer times, although according to theoretical estimate the limit of the predicted variation of weather is 14 days.

Q: How do you explain this? Why are there errors even in short-range forecasts?

A: I will note several reasons. Despite the fact that there are many meteorological stations, they are not distributed uniformly. The network of observations is quite dense in Europe, North America and in a number of regions of Asia. But in Latin America there are few such stations. Enormous expanses of the earth, especially in the southern hemisphere, and also the world ocean, exerting a considerable influence on atmospheric pressure, remain white spots in meteorological respects.

The system of polar-orbital meteorological satellites put into circumterrestrial orbit in the Soviet Union and in the United States has considerably expanded the information available about cloud cover, the boundaries of the snow and ice cover. However, for the time being we are not receiving the information on pressure, temperature, wind and humidity from satellites which is necessary for numerical models. We know only rather approximately concerning the state of the atmosphere due to the fact that the observation system still does not uniformly cover the earth. This also leads to forecasting errors.

The physical patterns of atmospheric processes controlling the formation of weather are very complex. Equally complex are the equations of hydrodynamics, these being used for computing motion of the atmosphere. It is necessary to solve them by approximate methods. This is also one of the reasons for errors. The atmospheric processes forming the weather have different dimensions and their lifetimes are also not identical. For example, cyclones extend from 500 to 5,000 kilometers and they exist from one to five or more days.

Cumulus clouds bearing rain or snow, however, extend over the earth for 10 to 50 kilometers and persist for only one or two hours.

Accordingly, it is necessary to have a tremendous amount of data in order to prepare a full and precise model of the state of the atmosphere. Tens and hundreds of thousands of different elements are taken into account. The longer the time for which we intend to determine the future weather, the greater the amount of information which is required and the greater is the volume of the computations which must be made. Therefore, particularly high requirements are imposed on electronic computers by weathermen. Even now many meteorological services are using electronic computers which carry out eight to ten million operations per second. Specialists feel that in the not distant future it will be necessary to have computers carrying out up to 50-100 million operations...

It must be mentioned that ten years ago the World Meteorological Organization and the International Council of Scientific Unions developed a program for the investigation of global atmospheric processes (GARP). An international tropical experiment in the Atlantic was carried out within the framework of this program. On the proposal of Soviet scientists a polar and a complex energy experiment have been carried out.

However, the First Global Experiment occupies first place in this series of investigations.

Q: What are the specific purposes of the experiment?

A: I will mention the most important. It is necessary to develop more perfect models of atmospheric processes, their interaction with processes transpiring in the world ocean, for precise weather prediction for a time from several days to several weeks. The objective has been formulated of clarifying the predictability of weather-forming systems and obtaining more effective methods for using meteorological and aerological methods for analyzing the atmosphere. The participants in the experiment have also been called upon to determine the optimum complex meteorological system of observations necessary for daily prediction of large-scale atmospheric formations.

Q: What scientific and technical forces are being used for global investigations?

A: The "region" of the experiment is becoming the entire earth. The existing observation network is broadening. Several more satellites will be launched into geostationary orbit. The processing of photographs of cloud cover from these flying laboratories will make it possible to obtain data on wind direction and velocity for two or three levels in the thickness of the atmosphere in the tropical zone. In the waters of the southern hemisphere there will be 300 drifting buoys outfitted with the latest instrumentation. They will supplement our ideas concerning the temperature and

humidity of the atmosphere in this region which is inaccessible for investigations.

Particular attention is being devoted to observations in the equatorial zone. For weathermen it is very important to have data on the wind at these latitudes. Plans call for sending 50 scientific research vessels and ten aircraft into this area for sounding the atmosphere. The countries have drawn up a plan for the collection and exchange of complete data.

During the time of the experiment an additional ten scientific research vessels under the flag of the USSR are being allocated for work in the tropical zone. Our hydrometeorologists are making preparations for the reception and processing of the data. At a number of institutes mathematical models are being created showing general circulation of the atmosphere and ocean.

There is no doubt but that the Soviet researchers participating in the international experiment will make their contribution to the further development of weather forecasting methods.

[50]

Abstracts of Scientific Articles

CHARACTERISTICS OF FIELDS OF CUMULUS CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 949-960

[Article by A. I. Furman, N. I. Goysa, A. S. Gorb and S. M. Rozhanets,
Ukrainian Hydrometeorological Scientific Research Institute, "Spatial-Tem-
poral Characteristics of the Fields of Cumulus Clouds"]

[Abstract] The solution of one of the most important problems of interaction of meso- and macrometeorological processes involves determining the correlation between the cloud cover and radiation fields. This article gives data from investigations of the fields of cumulus clouds using aircraft laboratories over the Ukraine and contiguous areas. In addition to standard equipment making it possible to obtain data on pressure, temperature and humidity, air speed and the microstructural characteristics of clouds, the aircraft carried actinometric instruments for registering descending and ascending fluxes of short-wave radiation. Measurements were made in horizontal flight over and under cumulus clouds. Usually two aircraft were used in synchronous flight at two levels. Data from a total of 486 flights were used during which about 12,000 clouds were measured. The distribution by synoptic situations was as follows: in anticyclones and in fields of increased pressure -- 55%, in cyclones and in fields of reduced pressure -- 38%, and in cold front zones -- 7%. In the overwhelming majority of cases these were air mass Cu. The spatial and temporal variability of the number of cumulus clouds was studied; it was found that the peak hours are 1100-1400 and 1700-1800 hours. The frequency of recurrence and interrelationship of the parameters of fields of cumulus clouds were investigated. Different figures and tables give such data as mean diameter of groups of clouds and individual clouds, mean distance between groups of clouds and individual clouds, cloud thickness, etc. It is shown that a detailed study of the parameters characterizing the mesostructure of cumulus clouds makes it possible to comprehend more fully the mechanism of radiation transfer under conditions of a discontinuous cloud cover and to evaluate more precisely the influence of cumulus clouds on the radiation characteristics of the atmosphere.

[53]

DISTRIBUTION OF METEOROLOGICAL ELEMENTS IN FORM OF UNCORRELATED STANDING WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 980-983

[Article by G. V. Rossikhin, Moscow Institute of Heat Engineering, "Distribution of Meteorological Elements in the Form of Uncorrelated Standing Waves"]

[Abstract] A study was made of the temporal variability of the vertical profiles of meteorological elements (wind and temperature) in the mesoscale region: from tens of meters to several kilometers in height and from several minutes to several hours in time. The author used the statistical characteristics of these meteorological elements based on the results of 1,500 pilot balloon optical measurements of the wind in a layer $y \leq 4$ km with a height interval 50-100 m and 500 radio pilot balloon measurements of the wind and temperature in a layer $y \leq 30$ km with a 1-km interval carried out in different time intervals: 5, 10, 30 minutes and 1, 2, 4 hours for optical wind measurements and 1, 2, 4, 6 hours for radio measurements of wind and temperature. These measurements were made during 1959-1970 in three regions of the USSR. The article describes the method used in processing the data by means of natural orthogonal functions and normalized time autocorrelation functions. On this basis the author then examines the complex problem of the distribution of meteorological elements in the form of uncorrelated standing waves. Comprehension of such distributions assists in solution of different problems of altitudinal-temporal, including mixed, extrapolation of meteorological elements in the considered region of scales.

[53]

UNIVERSAL FUNCTIONS APPLICABLE TO EKMAN BOUNDARY LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 984-988

[Article by L. Kostadinov and G. Dzholov, State Council, People's Republic of Bulgaria, "Universal Functions in the Laws of Resistance and Heat Exchange for the Ekman Boundary Layer"]

[Abstract] In this study the authors have used almost all known experimental data for determining the specific form of the universal functions A, B, C for stably and unstably stratified planetary boundary layers. In the case of an unstably stratified layer the specific form of the functions A, B, C is:

$$A = M_1 |\mu_0|^{-1/2}, B = \ln(|\mu_0|/\chi) - a_u + M_2 |\mu_0|^{-1/2}, C = \ln(|\mu_0|/\chi) - \alpha_0 a_v - M_3 |\mu_0|^{-1/2},$$

where M_1, M_2, M_3 are dimensionless constants; $a_u = 1, \alpha_0 a_s = 0.1$ are constants from the laws of resistance and heat exchange in the surface layer. In the case of a stably stratified layer: $A = N_1 \mu_0^{1/2}, B = \ln \mu_0 - N_2 \mu_0^{1/2}, C = \ln \mu_0 - N_3 \mu_0^{1/2}$, where N_1, N_2 and N_3 are dimensionless constants. The numerical values of the universal constants, determined on the basis of cited experimental data, are: for an unstable stratification -- $M_1 = 28, M_2 = 6, M_3 = -43$; for a stable stratification -- $N_1 = 2.2, N_2 = 2.8, N_3 = 5.5$. The values of the universal constants obtained in this study can be used in solving a number of mesometeorological problems and especially in parameterization of the boundary layer for a large-scale forecast.

[53]

III. OCEANOGRAPHY

News

VOYAGE OF SCIENTIFIC RESEARCH SHIP 'PEGAS'

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 753-755

[Article by A. Ya. Il'yev and A. A. Suvorov, "Twelfth Voyage of the Scientific Research Vessel 'Pegas'"]

[Abstract] A 50-day voyage of the scientific research vessel "Pegas" of the Sakhalin Multidiscipline Scientific Research Institute was completed on 15 January 1977. The voyage was organized in accordance with the program of the International Geodynamic Project on the problem of study of the active margin of the continent and ocean: arc-trench-ocean floor. The principal object of the investigations was the juncture of the Japanese and Idzu-Bonin trenches. The tasks of the voyage included a study of the patterns of change of the structure and thickness of the sedimentary stratum within the limits of the shelf, internal and external slopes of trenches, and also the axial part; establishment of correlations between the structure of the earth's crust and magnetic and gravitational fields; interpretation of the geological nature of the observed anomalies; study of the mineralogical composition and stratigraphy of formations. The voyage program also included the investigation of the spatial-temporal variability of the temperature field. For solution of the formulated problems specialists used a complex of geological-geophysical methods: continuous seismic profiling, gravimetry, magnetometry, echo sounding, geological dredging and hydrophysical stations. Thirty-two scientists participated. The ship left Korsakov on 26-27 November 1977 and reached the work polygon on 2 December; the ship returned to its home port on 15 January. The report cited above briefly summarizes the work of this voyage. Regional geological-geophysical investigations covered an area of about 600,000 km².

[32]

Abstracts of Scientific Articles

SPECTROMETER CALIBRATION FOR MARINE GAMMA SURVEY

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 739-743

[Article by V. V. Kostoglodov, Institute of Oceanology, "Calibration of Spectrometer for Marine Spectrometric Gamma Survey"]

[Abstract] The article describes a statistical method for calibrating a spectrometer for an underwater gamma survey of marine bottom deposits. The method is based on the use of linear regression analysis and makes possible rapid computation (using an electronic computer) of the most precise values of the calibration coefficients and their errors taking into account all the data obtained in measurements at calibration stations. It is noted that it is desirable that the calibration measurements be carried out at stations with sufficiently dense bottom material (sands, for example) because when measurements are made on unconsolidated material (oozes) there can be errors which are not taken into account due to the sinking of the spectrometer sensor into the bottom. At the present time this method is the most precise and the only one suitable for the calibration of gamma spectrometers for a continuous underwater survey of the surface layer of sea sediments.

[32]

EFFECT OF TIDAL CURRENTS ON UPPER BOUNDARY OF THERMOCLINE

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. FIZIKA, ASTRONOMIYA in Russian No 2, 1977 pp 74-76

[Article by N. K. Shelkovnikov, N. N. Seleznev, S. I. Zaytsev and A. A. Zamyatin, Department of the Physics of the Sea and Waters of the Land, Moscow University, "Influence of Tidal Currents on the Position of the Upper Boundary of the Thermocline"]

[Abstract] An attempt was made to determine the dependence of the position and structure of the thermocline on tidal currents in the sea. Measurements of the vertical distribution of temperature $T(z)$ were made in

Kandalakshskiy Gulf in the White Sea in July 1975. The rate of vertical sounding was limited by the thermal inertia of the sensor and did not exceed 50 cm/sec. Measurement accuracy was 0.1°C. Wind and waves were absent during the time when measurements were made for constructing the profiles. Two stations were occupied: at the times of ending of the incoming tide and the beginning of the ebb tide. The thickness of the isothermic layer at stations 1,2 in the final stage of the incoming tide decreased; this was evidently attributable to the fact that the measurements were made in the coastal zone at a depth of 15 m where the influence of friction against the bottom was expressed in the entire thickness of the flow, which in turn led to considerable changes in current velocity with depth. And since at the time of the incoming tide the motion of the water occurs in the direction of lesser depths, under these conditions advective transfer leads to a decrease in the thickness of the isothermic layer. Relatively small changes in the position of the thermocline at station 2 were probably attributable to the fact that the measurements were made more to the seaward, in the broader part of the gulf where the velocity of motion of the water during the incoming and outgoing tide was substantially less. Figures 1 and 2 in the text show the position of the upper boundary of the thermocline at stations 1 and 2 and an explanation is given for each change in direction of the curves on these graphs.

[29]

CONTRIBUTION TO THEORY OF ACTIVE LAYER OF OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 2, 1977 pp 325-328

[Article by Kh. Zh. Dikinov and A. I. Fel'zenbaum, Institute of Oceanology, "On the Theory of the Active Layer of the Ocean"]

[Abstract] In certain cases the active layer of the ocean can be studied independently of the other layers. In regions with slight advection it is possible to neglect processes caused by horizontal inhomogeneity. This makes it possible to have a one-dimensional model of the active layer. In this article it is shown that such a model can be constructed as a model of a boundary layer of finite thickness at the ocean surface. [As a simplification the author neglects salinity, assuming density to be a linear function of temperature.] In the considered problem there is no horizontal and vertical advection of heat since temperature and current velocity are not dependent on horizontal coordinates and the vertical component of current velocity is equal to zero. Two variants of the problem are considered. A series of formulas are derived, for example, one which can be used for determining the heat flux within the active layer. Two- and three-layer models are also considered.

[35]

FINE STRUCTURE OF TEMPERATURE FIELD IN KUROSHIO REGION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 971-979

[Article by V. S. Belyayev and A. N. Gezentsvey, Institute of Oceanology,
"Fine Structure of the Temperature Field in the Kuroshio Region"]

[Abstract] The article gives an analysis of the characteristics of the fine structure of vertical temperature profiles in the region of the southern subarctic front of the northwestern part of the Pacific Ocean. Data from eight soundings gave the distribution of the mean temperature and the mean square deviations of temperature with depth. The empirical distributions of the thicknesses of layers with a vertical temperature gradient constant in sign were different in depth intervals different with respect to density stratification conditions. The spectra of the vertical component of the temperature gradient obtained in a relatively broad range of wave numbers agree well with the data obtained by M. C. Gregg, et al. (J. PHYS. OCEANOGR., 3, No 4, 1973) and are indicative of the generation of small-scale turbulence in the ocean.

[53]

HYDROPHYSICAL EXPERIMENT ON BLACK SEA SHELF

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 989-990

[Article by Ye. A. Plakhin, Institute of Oceanology, "Formulation of a Long-Term Hydrophysical Experiment in the Shelf Region of the Black Sea"]

[Abstract] In November 1975 specialists in the Laboratory of Hydrological Processes at the Institute of Oceanology with the collaboration of specialists in the laboratory of the Southern Division Institute of Oceanology carried out a cycle of hydrophysical observations with a stabilized buoy placed in the Black Sea at a depth of 70 m. Self-contained current and temperature sensors were lowered from the buoy to a series of horizons (each 5-10 m). The discreteness of their readings made it possible to replace the instruments no more frequently than once in 1.5-2 months. On the upper platform of the buoy there were measurements with an eight-level mast (up to 60 m), making it possible to transmit information through a radio channel to an on-shore laboratory or make magnetic recordings aboard the buoy. The discreteness of the readings in this case could be set in a broad range (from 16 sec to 2.5 hours). Before the apparatus was used in the prolonged work cycle specialists had carried out several hydrological surveys and had set out three small self-contained buoys with current meters and temperature sensors in the layer 0-60 m, located at the vertices of an equilateral triangle with sides about 400 m long. Among the objectives of the

main study was an evaluation of the influence of small depths on the behavior of ordinary wave periods present in the ocean spectra. As expected, at such depths the temperature and current fields react to the variability of the main energy-carrying meteorological elements with a small time lag. Observations made over a month-long period indicated that in the temperature and current spectra, despite the shallow-water noise effect, there is retention of the principal periods of the disturbances which are present in the open ocean. It was concluded that the selected region of the Black Sea can be used for long-term hydrophysical observations carried out for the purpose of solving some special problems in marine physics.

[53]

REACTION OF HOMOGENEOUS OCEAN LAYER TO DEEP MESOSCALE EDDY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 4, 1977 pp 824-827

[Article by B. A. Nelepo, Yu. M. Kuftarkov and V. K. Kosnyrev, Marine Hydrophysical Institute Ukrainian Academy of Sciences, "Reaction of a Homogeneous Layer in the Ocean to a Deep Mesoscale Eddy"]

[Abstract] The authors of this paper propose a theoretical model of the upper layer of the ocean and have studied the evolution of the temperature field of this layer in the presence of a deep mesoscale eddy. (The model is based on equations derived by Yu. M. Kuftarkov, et al. in TRUDY MORSKOGO GIDROFIZICH. IN-TA, No 2, 1976.) The temperature field is represented in the form of the sum of the undisturbed (mean seasonal) and disturbed (synoptic) components. The undisturbed temperature is zonally homogeneous in the quasi-isothermic layer and horizontally homogeneous in the thermocline region. A disturbance arising in the lower layer models the temperature field of a cold isolated eddy with cyclonic rotation. In the vertical section the disturbance is represented by domes of cold water caused by displacement of the isotherms and in plan -- a system of closed isolines forming the nucleus of the eddy. Such a temperature distribution makes it possible to study in pure form the effect of the influence of the eddy on the homogeneous layer because only disturbed currents are present in the lower layer. A specific example is examined and the physical mechanism of the considered process is discussed. The article shows that under definite conditions the temperature of the homogeneous layer is a carrier of valuable information on the parameters of mesoscale eddies. This information can evidently characterize not only baroclinic, but also barotropic eddies which at the present time can be discovered only using buoy stations.

[51]

LABORATORY STUDY OF WIND WAVE GENERATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 9, 1977 pp 991-993

[Article by G. Ye. Kononkova, L. V. Poborchaya and K. V. Pokazeyev, Moscow State University, "Laboratory Investigation of Generation of Wind Waves in a Flow"]

[Abstract] The spectra of waves generated by the wind on initially motionless water and on the generated flow were investigated. A comparative analysis was made of the spectral characteristics of the waves for these two cases. The experiment was carried out in an aerohydrodynamic channel. The water flow was created by jets from 12 nozzles 1 cm in diameter distributed along the width of the channel and 2.5 cm beneath the water surface. The positioning of the nozzles and the water discharge from them was selected in such a way as to obtain a flow velocity constant in the width of the channel. Water depth was 30 cm. Measurements of fluctuations of the water surface were made by seven sensors of an automatic string wave recorder situated at distances of 46, 98, 170, 235, 250, 300 and 370 cm from the edge of the side slope. A diagram of the experimental apparatus accompanies the text. The manner in which the experiment was conducted is described. A wind apparatus was used; after attaining a stationary regime the fluctuations of the water surface were registered. The vertical wind profile was measured at heights from 2 to 30 cm from the undisturbed water level. The series of measurements were made for five wind regimes -- 35, 46, 65, 83 and 90 cm/sec. It was found that the generally accepted dependence of dimensionless frequency of the spectral maximum on the dimensionless parameter, correct in the entire region of wave development, beginning with $X > 100$, cannot be approximated in the region $X < 100$, where the initial generation of waves occurs. The high-frequency part of the spectrum in the region of wave generation has the following peculiarities: it lacks an equilibrium sector and the exponent n characterizing the decrease in spectral density $S(\omega) \sim \omega^{-n}$ with frequency has a high value 10 and is dependent on the dynamic velocity of the air.

[53]

IV. TERRESTRIAL GEOPHYSICS

Abstracts of Scientific Articles

TECTONICS OF SEA OF OKHOTSK SHELF

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 2, 1977 pp 419-422

[Article by Corresponding Member USSR Academy of Sciences S. L. Solov'yev, I. K. Tuyezov, M. L. Krasnyy and S. S. Snegovskoy, Sakhalin Multidiscipline Scientific Research Institute, "Tectonics of Sea of Okhotsk Shelf of Central Sakhalin"]

[Abstract] In a regional study of the shelf of Sakhalin the Sakhalin Multidiscipline Scientific Research Institute in collaboration with the Sakhalin Territorial Geological Administration in 1974 carried out geological-geophysical investigations which included the continuous seismic profiling method with an electrospark source of seismic energy with a power of about 150 KJ, magnetic measurements with a proton magnetometer, gravimetric measurements with three gyrostabilized gravimeters, echo sounding measurements and the taking of bottom sediments with a corer and dredge. The ship's position was determined using a "Don" radar station. More than 2,000 km of geophysical profiles were processed. Almost everywhere in the geological section it was possible to discriminate two strata. The upper stratum contains a great number of reflecting boundaries relatively poorly differentiated with respect to their acoustic properties; the lower stratum can be traced only along its surface. Fig. 1 shows examples of reflected waves - continuous seismic profiling sections; Fig. 2 is a map of the anomalous magnetic field; Fig. 3 is a tectonic regionalization map. All these data made it possible to trace the geological history of the region.

[35]

EQUIVALENCE IN INVERSE GRAVIMETRIC PROBLEM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 2, 1977 pp 329-331

[Article by V. N. Strakhov, Institute of Physics of the Earth, "Equivalence in the Inverse Gravimetric Problem in Cases of Variable Mass Density"]

[Abstract] At the present time in the geological interpretation of gravitational anomalies it is increasingly common to use models of sources with a variable density of masses, frequently without a proper mathematical basis, without investigation of uniqueness of solution of the problem within the framework of the selected model. A classical example of solution of the inverse problem assumes a spherically symmetric distribution of masses. It is assumed that $x = (x_1, x_2, x_3)$, $|x| = \sqrt{x_1^2 + x_2^2 + x_3^2}$ and it is assumed that $\delta(t)$ is a function measured and summed in the interval $[0, R]$. For a distribution of masses with the density $\delta(|\xi|)$ the potential of the external gravitational field is

$$U(x) = \frac{fm}{|x|},$$

where

$$m = \int_0^R \delta(t) dt,$$

m is the total mass and f is the universal gravitational constant. It is evident that if $m = 0$ the potential is identically equal to zero everywhere outside the sphere $|x| \leq R$. Among geophysicists the conviction is quite widespread that such a strong equivalence (for any $\delta_1(t)$ and $\delta_2(t)$ the external potentials are equal, assuming the total masses m_1 and m_2 are equal) is characteristic only of spherically symmetric distributions and in the case of an arbitrary volume V occupied by masses such an equivalence cannot occur. The main purpose of this article is to show that this conviction is erroneous.

[35]

VOLUME RECONSTRUCTIONS OF HEAT FIELDS OF GRANITIC INTRUSIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 2, 1977 pp 411-414

[Article by Yu. I. Demin, G. G. Korolev and A. A. Solodov, Moscow State University and Central Scientific Research Geological Prospecting Institute of Ferrous and Precious Metals, "Volume Reconstructions of Heat Fields of Granitic Intrusions and Their Use in Metallogenetic Investigations (in the Example of the Zmeinogorskiy Region in the Rudnyy Altay)"]

[Abstract] The temperature regime of metamorphism and redeposition of ores in deposits is determined on the basis of solution of equations describing heat exchange between intrusive bodies and the country rocks, which makes it possible to evaluate the change in temperatures in time and space. The use of this method requires a study of the conditions for the formation of intrusive bodies, their extent and morphology and the structure of the country rock. This method was used by the authors in computing the temperature fields of granitoids in the Zmeinogorskiy ore region. For clarifying the morphology of granite masses at depth use was made of a map of local

gravimetric anomalies on the basis of which, taking all available geological data into account, it was possible to construct a density model of the Zmeinogorskiy ore region. The final result of the quantitative interpretation of the local gravimetric anomalies was a map of elements of deep structure which showed regions of development of Lower Paleozoic metamorphic shales, undissected strata of Devonian deposits and morphology of granite masses. The principal stages in the volume reconstruction are defined. The importance of such studies in metallogenetic investigations is discussed.

[35]

PROBLEMS IN STUDY OF RELIEF IN AIRBORNE GRAVIMETER SURVEY

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. GEOLOGIYA in Russian No 3, 1977 pp 123-125

[Article by V. Ye. Mogilevskiy, Department of Geophysical Methods for Investigating the Earth's Crust, Moscow University, "Correlation of Statistical Characteristics of Corrections for Relief and Local Relief in Aerial Gravimetry"]

[Abstract] Due to the inaccessibility of mountainous regions from the ground it is desirable to make gravimetric surveys from the air. But in the mountains there is an extremely great attraction of relief which enters as interference into the measured gravity anomalies. The need for taking this gravity component into account makes it necessary to study the field of attraction of relief in external space. It is particularly interesting to clarify how it changes with a change in altitude because the possibility of measuring the gravity field at different levels is one of the advantages of the airborne gravimeter method. In this work a statistical approach is justified because it is virtually impossible to approximate mountainous relief by an analytical function. Therefore, in this study the elevation of the physical surface is regarded as a stationary random function of the space coordinate. In such an approach the field of attraction of relief, functionally related to the elevation of the physical surface, must also be regarded as a random function of space coordinates. The author therefore examines the problem of determining the statistical characteristics of the field of attraction of relief on the basis of the statistical characteristics of relief. As a simplification, the two-dimensional problem is solved, but all the conclusions drawn can be applied to a three-dimensional case.

[30]

GENERAL FORM OF SOLUTION OF INVERSE GRAVIMETRIC PROBLEM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 235, No 6, 1977 pp 1281-1284

[Article by V. N. Strakhov, Institute of Physics of the Earth, "One General Form of Solution of the Inverse Gravimetric Problem"]

[Abstract] Inverse problems in gravimetry are extremely ambiguous and have exceptionally unstable solutions even in those model classes in which the uniqueness of solution of the inverse problem does exist. Therefore, investigation of the ambiguity of solution of the gravimetric problem is of considerable practical and theoretical interest. Assuming $x = (x_1, x_2, x_3)$,

$$|x| = \sqrt{x_1^2 + x_2^2 + x_3^2},$$

$u(x)$ is the potential created by the masses concentrated in a known finite simply connected volume V , bounded by a quite regular surface ∂V . It is well known that in this case on the basis of the stipulated potential $u(x)$ (or as happens in actual practice, its derivative $\partial u(x)/\partial x_3$) there can be an unambiguous restoration of the equivalent simple layer; its density is denoted $\sigma(\xi')$:

$$u(x) = f \int_{\partial V} \frac{\sigma(\xi')}{|\xi' - x|} dS_{\xi'}, \quad x \in G(\bar{V});$$

here f is the universal gravitational constant. The problem considered in this paper is to find in a stipulated class P the general form of the volumetric distributions of masses in V giving rise to the stipulated potential $u(x)$ or (which is the same) creating at ∂V an equivalent simple layer almost everywhere coinciding with the stipulated layer $\sigma(\xi')$. The principal results of this study are: 1) if the stipulated volume V contains field sources, on the basis of the external field in V it is always possible to construct a family of equivalent distributions of masses dependent on an arbitrary function; 2) special solutions can be defined from a family of equivalent solutions on the basis of reasonable extremal principles; the finding of solutions of the inverse problem is thus reduced to some optimum control problem.

[3]

SEISMOGEOLOGICAL STRUCTURE OF CRUST ON KOLA PENINSULA

Moscow SOVETSKAYA GEOLOGIYA in Russian No 7, 1977 pp 105-111

[Article by G. D. Panasenkov and N. V. Sharov, Geological Institute Kola Affiliate USSR Academy of Sciences, "Seismogeological Structure of the Earth's Crust on the Kola Peninsula Along the Profile Kovdor-Kirovsk"]

[Abstract] The article examines the results of a complex study of the earth's crust on the Kola Peninsula along a 150-km reconnaissance profile between Kovdor and Kirovsk run by the seismic prospecting and seismological methods with the use of explosive shots at the mining enterprises at Kovdor and Kirovsk as sources of seismic oscillations. The Mohorovicic discontinuity was traced reliably at depths of 30-40 km and it was found that there is a tendency to a dropoff of the M surface from west to east. Also confirmed is an easterly plunging of fragments of discontinuities within the crust. The existence of a complex transition zone at the bottom of the crust is postulated for the central part of the profile. Seismic criteria make it possible to detect several deep faults. The zone of these faults is discriminated most reliably in the zone of juncture of the White Sea meganticlinorium and the Kola megasynclinalorium, which is a system of extremely thick zones of complexly deformed rocks which breaks through the entire thickness of the earth's crust and which sends its roots into the mantle. The crust in the investigated region in seismic respects has a layer-block structure. The stratification is manifested at all horizons, including the crust-mantle transition zone. The investigation revealed that the registry of seismic fields from industrial shots is an effective and relatively inexpensive method for obtaining valuable scientific information on deep structure of the earth's crust and the upper horizons of the mantle.

[48]

CONSTRUCTING MAPS OF SEISMIC ACTIVITY AND MAXIMUM POSSIBLE EARTHQUAKES

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 3, 1977 pp 49-54

[Article by M. Kurbanov, T. N. Gorodkova and E. S. Vorontsova, Institute of Physics of the Earth and Atmosphere Academy of Sciences Turkmen SSR, "Use of Geophysical Parameters in Constructing Maps of Seismic Activity (A) and Maximum Possible Earthquakes (K_{max}) for Eastern Turkmenia"]

[Abstract] The authors of this article for the first time have used the Yu. V. Ryznichenko method for constructing maps of seismic activity and the maximum possible earthquakes for Turkmenia on the basis of complex seismological and geological-geophysical data. This involved an analysis of the nature of the distribution of geological-geophysical parameters for the territory of Eastern Turkmenia. Separate sections in the paper describe the characteristics of the gravitational field in Bouguer anomalies and the averaged geomagnetic field. Figure 2 in the text shows seismic activity maps constructed by two methods. Figure 3 shows maps of the maximum possible earthquakes constructed by two methods. These studies have made it possible to clarify still more clearly those zones in Turkmenia where the seismic danger is most serious.

[52]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

COMMENTS ON 'SOYUZ-25' LANDING

Moscow IZVESTIYA in Russian 12 Oct 77 p 2

[Article by B. Konovalov: "Cosmonauts are in 'Zvezdnyy Gorodok'"]

[Text] On the huge map in the main hall of the Flight Control Center near Moscow a red dot represents the "Soyuz-25" which is moving along a white sine-curve flight trajectory superposed on an image of the continents and oceans of our planet. On display panels one can see flashing figures counting off the hours and minutes which in measured time approach the designated time of landing of the spaceship.

The braking engine of the vehicle was fired over the Atlantic and the ship entered a descent trajectory. It was reported to the Control Center from the ship "Borovich" that the engine fired for the stipulated time and was then shut down. Now the "Soyuz-25" is moving downward toward the earth. The modules were separated over Africa. Now only the descent module is descending to the earth toward the intended region. This module has a powerful thermal shielding system which must guard the cosmonauts against the fiery grip associated with re-entry into the dense layers of the atmosphere.

At an altitude of approximately 100 km, when the cosmonauts were flying somewhere over Turkey, atmospheric drag becomes appreciable. Accelerations appear and sparks from the burning shielding can be seen outside the window. Gradually the madly whirling vehicle is enveloped in howling flame. But by its very burning the shielding safeguards the ship and upon extinguishing its velocity it can already safely release its parachutes.

It is reported from the aircraft and helicopters of the search service that they see the descending ship. Communication has been established with Kovalenok and Ryumin. In the landing area, 185 kilometers from Tselinograd, it is cloudy and windless.

"The landing was successful!" it was reported to us at the Center.

Now on the map in the main hall there is only one trajectory with a green dot for the "Salyut-6." The Control Center is continuing work with the station.

Aboard helicopters the cosmonauts are flying to Tselinograd and from there will fly by plane to Moscow. At 3 P.M. the "Soyuz-25" crew will be met at an airport near Moscow. Now the aircraft is taxiing up to the crowd. The door swings open. And now Vladimir Kovalenok is giving a report to the Chairman of the State Commission that the flight of the "Soyuz-25" has been completed. The cars are heading to Zvezdnyy Gorodok where a meeting will be held.

[46]

TASS ANNOUNCES LAUNCHING OF MANNED SPACESHIP 'SOYUZ-25'

Moscow PRAVDA in Russian 10 Oct 77 p 1

[TASS Report: "'Soyuz-25' in Orbit"]

[Text] In accordance with the space research program, on 9 October 1977 at 0540 hours Moscow time in the Soviet Union the "Soyuz-25" spaceship was launched, piloted by flight commander Lieutenant-Commander Vladimir Vasil'yevich Kovalenok and flight engineer Valeriy Viktorovich Ryumin.

The execution of joint experiments with the scientific station "Salyut-6," which was inserted into near-earth orbit on 29 September 1977, is specified by the flight program of "Soyuz-25."

On-board systems are functioning normally and the crew is doing well.

Cosmonauts Kovalenok and Ryumin have begun to carry out the flight program.

FLIGHT CONTROL CENTER. By 1200 hours Moscow time the "Soyuz-25" spaceship had completed five revolutions of the earth.

After today's trajectory correction, "Soyuz-25" continues in an orbit with the following parameters:

- apogee, 318 kilometers;
- perigee, 280 kilometers;
- period of revolution, 90.2 minutes;
- orbital inclination, 51.6 degrees.

In radiocommunication sessions Commander V. V. Kovalenok reported that the crew is conducting the projected flight program and that the cosmonauts are well.

From 1400 to 2300 hours "Soyuz-25" will be outside of the USSR radio contact zone. During this time the cosmonauts will rest. [5]

FAILURE OF 'SOYUZ-25' DOCKING ATTEMPT

Moscow PRAVDA in Russian 11 Oct 77 p 1

[TASS Report: "'Soyuz-25' in Flight"]

[Text] FLIGHT CONTROL CENTER. The second working day in flight of cosmonauts Vladimir Kovalenok and Valeriy Ryumin began yesterday at 2330 hours Moscow time.

In accordance with the flight program the cosmonauts checked out "Soyuz-25" on-board systems and conducted planned studies.

On 10 October 1977 at 0709 hours the automatic rendezvous of "Soyuz-25" with the "Salyut-6" station was begun, and then from a distance of 120 meters the final approach was conducted.

Due to deviations from the specified approach mode, docking was aborted.

The crew began preparation to return to earth.

The orbital scientific station "Salyut-6" continues its flight. [5]

TASS ANNOUNCES LANDING OF 'SOYUZ-25'

Moscow PRAVDA in Russian 12 Oct 77 p 1

[TASS Report: "'Soyuz-25' -- Flight Concluded"]

[Text] On 11 October 1977 when work had been concluded on "Soyuz-25" cosmonauts Vladimir Vasil'yevich Kovalenok and Valeriy Viktorovich Ryumin returned to earth.

At 0626 hours Moscow time the descent vehicle with the cosmonauts made a soft landing on Soviet territory 185 kilometers northwest of Tselinograd.

Before the descent from orbit the cosmonauts oriented the ship, and then the braking engine was fired. After engine shutdown, separation of the compartments occurred and the descent vehicle passed into the descent trajectory.

After braking in the atmosphere, the parachute system was put into operation at the calculated altitude. The soft landing engines were immediately activated close to earth and the descent vehicle landed at the planned site.

Cosmonauts V. V. Kovalenok and V. V. Ryumin are in good health after landing. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-958"

Moscow PRAVDA in Russian 13 Oct 77 p 2

[TASS Report: "'Kosmos-958'"]

[Abstract] The artificial earth satellite "Kosmos-958" was launched in the Soviet Union on 11 October 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 90.5 minutes;
- apogee, 369 kilometers;
- perigee, 265 kilometers;
- orbital inclination, 62.8 degrees.

COMMENTS ON 'SOYUZ-25' DOCKING PROCEDURE

Moscow PRAVDA in Russian 11 Oct 77 p 6

[Article by V. Gubarev, "We See the Station"]

[Text] The Flight Control Center meets the second dawn.

0700 hours. In a few minutes there will be the next communications session. The "Soyuz-25" has already made four maneuvers in space, forming an orbit for rendezvous with the station. Now the distance to the "Salyut" is about three kilometers.

The "Soyuz" crew flew around the earth 18 times. And the "Salyut-6" has begun its 175th revolution.

"Range 2,500 meters... Braking engine fired." The Flight Control Center hears the voice of Vladimir Kovalenok.

The red and green dots on the screen -- the "Soyuz-25" and the "Salyut-6" -- are right alongside one another. They are flying over the Mediterranean Sea.

The crew for the first time saw the "Salyut" when it was still several kilometers away.

"A shining point is appearing on a black background." That is the way the flying cosmonauts characterize the meeting with the station. "The artificial star is burning brightly and is beckoning to us." This is a very emotional moment in the flight. And a very serious one. Each crew is excited. In space flight you live at all times a little in the future. After all, all the stages were practiced in training sessions; they have become second nature. Having done one thing, you think then about the next stage in the program.

Naturally, Kovalenok and Ryumin were excited: they talked much more rapidly than usual.

The automatic systems work precisely. The "Soyuz" moves evenly and smoothly. The crew checks the operation of the instrumentation.

The "Soyuz-25" and the "Salyut" are now over the Black Sea.

"How is it aboard?" they ask from the earth.

"According to our data, everything is normal."

"And according to ours as well..."

"Range 240 meters...the ship is rotating" reports V. Kovalenok.

The vehicles approach and the docking segment begins.

We wait. Difficult, exciting minutes. All understand very well that simply anything is possible in space.

"The station can be seen clearly" -- this is the voice of Valeriy Ryumin.

The docking of the ship to the station is a complex process. This requires not only the highest mastery on the part of the crew, but also faultless operation of all the technical systems. The docking fails due to an unexpected malfunction in the docking regime.

"'Fotony', this is 'Zarya'. I am refining the data for the next revolution ..."

Each flight into space is a testing of both man and equipment. Exceedingly complex techniques are involved...

"Take off your space suits and rest," ordered the Control Center.

"Message received," was the response from space.

The "Soyuz-25" crew has begun preparations for the landing.
[45]

COMMENTS ON INITIAL ORBITS OF 'SOYUZ-25'

Moscow PRAVDA in Russian 10 Oct 77 pp 1,4

[Article by V. Gubarev, "First Orbits"]

[Excerpt] Flight Control Center. The Flight Control Center has taken up the space watch over Baykonur.

"'Fotony', this is 'Zarya'. I congratulate you on the emergence into orbit. How are you there aboard?" was heard the businesslike voice of Aleksey Stanislavovich, as was befitting the flight director.

"Everything with us is fine."

"Proceed to the implementation of the work program."

Twenty minutes ago the "Soyuz-25" was still on the earth. This quarter of an hour not only for V. Kovalenok and V. Ryumin, but also for the thousands of specialists making ready for the flight, was saturated with the entire breadth of human emotions: from alarm and excitement to joy and happiness. And this was conspicuous from the faces of all who were here this night at the Flight Control Center. Together with the cosmonauts they passed along the "active segment," tracing the red dot creeping along the screen, the ship in which two human hearts beated.

"There is a little trembling...The accelerations can scarcely be felt," reports the commander.

But we do not see the face of the ship's engineer. V. Ryumin holds in his hands the logbook and is writing something in it.

"Look, this is the earth!" says V. Kovalenok.

"There is plenty to look at..."

The men are going into space. Both for the first time. But such a sensation that this extraterrestrial road to very familiar to them.

"Our feeling of well-being is normal. It is as if we are in a trainer."

"Here it is even a little quieter," adds Ryumin.

"Now the sun has appeared in the window. It is meeting us..."

They are already in space.

"An ordinary matter?" Aleksey Arkhipovich Leonov smiles. "To be sure, Vladimir and Valeriy know much about the segment into which they are put into orbit and on weightlessness. Only Yuriy Gagarin knew nothing about it but we already had some idea about what space is like. But it is a completely different thing to experience it yourself. In the sector into which it is launched the seconds go by slowly. You await weightlessness. And nevertheless it appears unexpectedly. Tiny particles, dust and different objects float up immediately from somewhere. Although the ship has been carefully cleaned, suddenly everything floats up and hovers around you. And the arms also. But you are still harnessed and do not visualize what weightlessness really is. Take off the restraints and weightlessness immediately makes itself felt; you are bound to knock your head against the ceiling. 'Hello, space.' After this reminder you understand that you have to get used to weightlessness. But a day later you can already control your movements -- you learn to float. However, Vladimir and Valeriy now have no time to think of their sensations. They are already at work. Listen! 'Zarya' is giving one command after another..."

First revolution -- checking of the on-board systems and instrumentation. On the second revolution -- opening of the hatch into the orbital compartment, removal of the spacesuits and dinner. Mention of this involuntarily elicited a smile: after all, here on earth the morning had only begun and no one had yet had breakfast. But space changes ideas about many things and particularly about the change of night and day. Now V. Kovalenok and V. Ryumin will live in accordance with their "extraterrestrial schedule," whereas the earth will completely conform to their work rhythm.

The "Soyuz-25" ship has made its first revolution, whereas the "Salyut-6" has made its 158th. On the screen we see the red and green dots together. When the ship is flying over the Black Sea the station is over Vladivostok. But the distance between them is gradually shrinking. After all, the "Soyuz-25" and the "Salyut-6" are to perform joint work in space.

[44]

Abstracts of Scientific Articles

E_s BEHAVIOR IN FIELD OF STRONG RADIO WAVE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 639-644

[Article by S. I. Kozlov, Ye. B. Krokhmal'nikov, V. I. Novozhilov, V. V. Popok, S. M. Savel'yev and G. K. Solodovnikov, "Behavior of the Sporadic E Layer in the Electromagnetic Field of a Strong Radio Wave. II"]

[Abstract] This is the second part of this study (see GEOMAGNETIZM I AERONOMIYA, 17, 433, 1977). In that article the authors described a series of experiments with slant heating of the E_s layer by decameter waves. In conducting the experiment of 23 July 1974 there was a clearly expressed decrease in the critical frequency f_0E_s which correlated well with the time of switching on of a powerful transmitter. This second part of the study gives a theoretical interpretation of these data. It is concluded that this is associated with heating of the neutral gas in the ionosphere and the development of convective instability, but more probably can be explained by applying wind shear theory of the formation of the middle latitude E_s layer with the participation of metal ions: an increase in the temperature of the electron gas under the influence of a strong radio wave leads to an increase in the coefficient of ambipolar diffusion, which is the reason for dispersion of the sporadic layer in which metal ions M^+ dominate over ordinary molecular ions NO^+ and O_2^+ .

[14]

EFFECT OF GRAVITATIONAL WAVES ON ION FORMATION IN LOWER IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 649-654

[Article by M. A. Nikitin and N. M. Kashchenko, Kaliningrad State University, "Nonstationary Ion Formation in the Lower Ionosphere Under the Influence of Gravitational Waves"]

[Abstract] The authors give an analytical examination of nonstationary effects in the lower ionosphere under the influence of gravitational waves. It was possible to obtain time dependences for the extremal values of

electron concentrations describing the dynamics of formation of an inhomogeneous layer from the initial uniform distribution under the influence of gravitational waves while neglecting diffusion and the multicomponent nature of the formation. Two special cases are examined for the effect of gravitational effects on the lower ionosphere: low frequency effect, $\omega/Ak \ll 1$, and high frequency $\omega/Ak \gg 1$. There is a strong dependence of nonstationary effects of gravitational waves in ion formation processes in the lower ionosphere on the parameter ω/Ak . Only for small values of this parameter does the electron concentration in the lower ionosphere experience significant deviations from an equilibrium value, determined by the effect of local processes of ion formation and recombination. For large values of the parameter ω/Ak the influence of gravitational waves on the electron concentration of the lower ionosphere (under certain conditions) is insignificant. [ω is the angular frequency of the gravitational wave, A is the amplitude value of the rate of vertical transport of ionization, $k - z$ is a component of the wave vector of the gravitational wave]

[14]

EFFECT OF IONOSPHERIC DISTURBANCES ON HYDROMAGNETIC WAVES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 655-662

[Article by V. M. Davydov, Institute of Space Physics Research and Aeronomy, Yakutsk Affiliate Siberian Department USSR Academy of Sciences, "Parametric Effect of Quasiperiodic Disturbances of the Lower Ionosphere on Directed Hydromagnetic Waves"]

[Abstract] On the basis of an analytical solution the author has computed theoretical magnetograms and has investigated the parametric influence of quasiperiodic disturbances in the lower ionosphere on geomagnetic pulsations. It is shown that the parametric interaction between directed hydromagnetic waves and conductivity fluctuations in the lower ionosphere leads in a general case to a multiplication of frequencies and the appearance of a scattered electromagnetic wave at these frequencies. This wave causes distortions in the form, amplitude-phase frequency and polarization (including field rotation) characteristics of geomagnetic pulsations. In particular, in the case of an initial sinusoidal process a nonsinusoidal oscillation is formed which is enriched by both long- and short-period components.

[14]

PHOTOGRAPHIC EXPERIMENTS ABOARD 'SOYUZ-9'

Moscow IZVESTIYA VUZOV, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 3, 1977 pp 58-61

[Article by Cosmonaut A. G. Nikolayev, "Photographic Experiments from Aboard the 'Soyuz-9' Spacecraft"]

[Abstract] For carrying out the complex photographic experiment aboard the "Soyuz-9" there was photographic equipment supplied with different kinds of photographic film (black-and-white, color, spectrozonal) and light filters. A synchronous survey in several spectral zones made it possible to obtain a set of narrow-spectrum images from which it was possible to synthesize black-and-white, spectrozonal and color photographs. Such a survey, made with optical-electronic scanning systems, made it possible to detect physicochemical characteristics of the photographed features which are not visible to the naked eye. Space photographs with a high resolution have a high information content, which in turn makes it possible to study both considerable territories and selected sectors with a greater detail. As illustrated by a photograph in the text, one such photo made it possible to carry out regionalization of Kara-Bogaz-Gol salt deposits which were inaccessible for ground investigations. This facilitated determination of the reserves of chemical raw material. The figure shows that in both the northern and eastern parts of Kara-Bogaz-Gol there is a broad zone of salt deposits periodically inundated by the waters of the gulf due to changes in level. It is easy to trace old shorelines, making it possible to study stages in its dessication. Light spots of solonchaks can be seen on the western and southern shores. Space surveys made it possible to obtain information on the territory of the Rudnyy Altay, the basic raw material base of polymetals; new, highly promising petroleum and gas regions were discovered (Turanskaya Platform, Western Siberia). Study of materials from space surveys are making it possible to solve a number of important economic problems in the exploitation of such regions as the Caspian basin and Central Asia, in the search for deposits of petroleum, gas and construction materials, in locating dam sites and in predicting the development of fishing.

[5]

FINDING ZONAL STATISTICAL PARAMETERS FROM COLOR SPACE PHOTOS OF MOON

Moscow IZVESTIYA VUZOV, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 3, 1977
pp 79-83

[Article by Yu. B. Petrov and A. Ye. Altynov, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Determination of Some Zonal Statistical Parameters Using Color Space Photographs of the Moon"]

[Abstract] Photographing of the moon on color photographic material with a three-layer structure is equivalent to multizonal photography in three zones of the visible part of the spectrum in accordance with the spectral characteristics of each of the layers. This circumstance makes it possible to ascertain the dependence of the change in the statistical parameters of a feature on the basis of its photographic image within the limits of the spectral range 400-750 nm, to which the photographic material is sensitized.

The great information content of the statistical parameters obtained by the optical correlation method makes it possible to discriminate the most informative sector in the optical range because the spatial structure of the photographic image (spatial spectrum) is probably dependent on the range of wavelengths in which the photography was taken. In the example of a space photograph of the moon taken from aboard the "Zond-7" it was possible to obtain estimates of some statistical parameters of the image in different parts of the visible range of the spectrum. All the estimates were made using the algorithms presented in this paper by the optical correlation method. The discrimination of the necessary part of the spectrum in the process of correlation measurements was carried out using light filters with a transmission band related to the spectral characteristics of one of the layers of the photographic film. For example, for discriminating the elements of the photographic image corresponding to blue light, in the course of the measurements use was made of a yellow zonal filter for discriminating the elements formed by a yellow color from the tricolor image. A table gives the results of measurements of the principal statistical parameters of characteristic parts of the photographic image of the visible side of the moon in the spectral zones corresponding to the three principal colors of the film used and the parameters of the three-color image. An analysis of the sectors classified in selenology as "continents" and "maria" indicates a characteristic differentiation of the statistical parameters both with respect to relief sectors and with respect to the optical range. In this case the most informative component in the three-color image is the image component corresponding to green light, followed by red. Thus, it is possible to speak of the required sensitizing of spectrozonal films intended specially for lunar surveys.

[5]

THERMAL RADIO EMISSION OF VENUS AND ITS RADIOMETRIC ALBEDO

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 3, No 8, 1977 pp 368-372

[Article by L. V. Ksanfomaliti, Space Research Institute, "Some Characteristics of Global Thermal Emission of Venus and its Radiometric Albedo"]

[Abstract] In October 1975 radiometers carried aboard the Venusian artificial satellites were used in investigating the equatorial zone of the planet in the latitude range -40° - $+50^{\circ}$. A search for latitude effects was totally negative but there was found to be a strong diurnal component of thermal IR radiation of the planet. The measurements were made in the radiometer spectral range 7.4-13.3 and 17.7-30 μ m. It is shown that the global thermal emission of Venus can be represented by the sum of the emissions of the two hemispheres, daytime and nighttime, with different laws of darkening toward the limb and temperatures. The refined characteristics of thermal emission make it possible to separate the eastern and

western hemispheres and to ascertain the emission characteristics of nine zones. The radiometric albedo of Venus was found to be

$$0.79^{+0.02}_{-0.01}.$$

A more precise value can be obtained when it is possible to take the Venusian polar regions into account.

[6]

REVIEW OF MAGNETISM OF PLANETS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 569-595

[Article by Sh. Sh. Dolginov, "Planetary Magnetism"]

[Abstract] This review of the literature on planetary magnetism is an attempt at integration and interpretation of the 105 cited sources in the literature. After generalizations concerning the magnetic fields of the planets, individual sections deal with what is known concerning the magnetic fields of the Earth, Jupiter, Mars, Mercury and the Moon. The common properties of planetary magnetic fields are considered. The author then gives an in-depth comparison of the magnetic fields of the planets. A special section deals with currents and forces in the core. The magnetic fields of planets in a precession dynamo model are compared; particular attention is given to the energy aspects of a precession dynamo. The magnetic fields of planets in a kinematic model are also compared. The results of investigations of planetary magnetic fields presented in this review indicate that only within the framework of comparative planetology is it possible to solve the problem of the origin and moving forces in the earth's magnetic field.

[14]

DETERMINING PARAMETERS OF SOLAR PROTONS IN EARTH'S NEIGHBORHOOD

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 596-602

[Article by S. T. Akin'yan and I. M. Chertok, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Determination of the Parameters of Solar Protons in the Earth's Neighborhood from Radio Bursts. III. Time Reference Functions"]

[Abstract] For the first and second parts of this study see GEOMAGNETIZM I AERONOMIYA, 17, 10, 177, 1977. There the authors in the example of a very simple initial parameter, the maximum intensity of microwave radio bursts at a frequency of 3 GHz, presented a model which on the basis of radio data makes it possible to carry out estimates of the intensity of proton fluxes

reaching the earth ($E > 10, 30$ and 60 MeV) taking into account the heliolongitude of the corresponding flares and the conditions for the escape of particles into interplanetary space. This paper gives the results of an analysis of the time parameters of a base set of proton phenomena, including the increases in the proton fluxes for the most part during 1965-1969 which are characterized at the earth by a maximum intensity of particles with $E > 10$ MeV $J \gg 1 \text{ cm}^{-2} \text{ sec}^{-1} \text{ sr}^{-1}$ and which are identified unambiguously with flares. The patterns which are clarified in such an analysis are expressed through the corresponding time reference functions and can then be used in the description of really observed flares.

[14]

STRUCTURE OF INTERPLANETARY PLASMA FROM POWERFUL FLARE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 603-610

[Article by K. G. Ivanov and N. V. Mikerina, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Structure of a Typical Stream of Interplanetary Plasma from a Powerful Flare and the Corresponding Set of Types of Geomagnetic (Magnetospheric) Disturbances"]

[Abstract] The study of the relationship between the structure of a flare stream of interplanetary plasma and geomagnetic disturbances is an important direction in solar-terrestrial physics. In this article, on the basis of possible modifications of the typical structure of a flare stream and the expected geoeffects of elements of this structure the authors describe the anticipated set of types of geomagnetic disturbances and cite examples confirming the reality of these relationships. It is shown that not one type, but a definite set of types of geomagnetic disturbances corresponds to each interplanetary structure. The article makes clear what a great diversity of situations exist in the interplanetary medium, arising after powerful solar flares, and the still greater diversity of geomagnetic disturbances corresponding to them. The article makes clear the real possibilities existing for the systematic classification of these events.

[14]

OBSERVATIONS AND REGISTRY OF CLOUD COVER OF VENUS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1977 pp 7-10

[Article by A. I. Lazarev, "Peculiarities of Observation and Registry of the Cloud Cover of Venus"]

[Abstract] On the basis of an analysis of experimental data obtained from the "Venera" and "Mariner" space probes a hypothesis is expressed concerning the composition and spatial distribution of Venusian clouds. The cloud

layer of Venus is localized in the troposphere at altitudes of 55-65 km. It consists for the most part of a water vapor condensate and is not a continuous formation covering the entire planet. An analysis of the principal parameters of the Venusian atmosphere makes it possible to postulate the existence of life in the Venusian atmosphere. This hypothesis seems somewhat unusual for the surface and lower layers of the atmosphere, where the temperature attains almost 500°C, which evidently precludes the possibility of life. But at altitudes 50-70 km, where the temperature is from -50 to +50°C and the pressure is 0.3-1.5 atm and where there is much carbon dioxide and oxygen and water vapor are present, the existence of some forms of life is probably possible. Flightcraft such as balloons, dirigibles and aircraft evidently can remain a long time at these altitudes. Such vehicles can be used for direct investigation of the physical parameters of the atmosphere and the possibility of existence of life in the atmosphere.

[31]

EXCITATION OF ACOUSTIC-GRAVITATIONAL WAVES IN ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, 1977 pp 756-758

[Article by L. M. Alekseyeva, Nuclear Physics Institute, Moscow State University, "Excitation of Acoustic-Gravitational Waves in the Atmosphere by Variations of Ionospheric Pressure"]

[Abstract] Variations in ionospheric pressure are regarded as a possible source of acoustic-gravitational waves in the atmosphere. Within the framework of the one-dimensional problem it is possible to obtain the spectrum of resonance frequencies, the least of which ω_1 slightly exceeds the higher frequency of internal gravitational waves. With a frequency of the source close to ω_1 the amplitude of the pressure disturbance is maximum near the earth's surface. The author discusses the problem of the possible relationship between such disturbances in the high-latitude atmosphere and the development of ionospheric current systems. It has been noted that there are large changes in ionospheric parameters during the period of geomagnetic disturbances, including wind velocity and density of the neutral gas. This means that in magnetically disturbed periods ionospheric movements to a certain degree are independent of atmospheric movements. Accordingly, the author analyzes how the lower-lying atmosphere reacts to a change in ionospheric pressure. The described mechanism should be manifested together with an intensification of the current system in the ionosphere sooner than the time when the intensifying currents appreciably heat the ionosphere.

[14]

RADIATION OF ACOUSTIC-GRAVITATIONAL WAVES DURING METEOR MOTION

Moscow IZVESTIYA AN SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 9, 1977 pp 926-935

[Article by G. S. Golitsyn, G. I. Grigor'yev and V. P. Dokuchayev, Gor'kiy Scientific Research Radiophysics Institute, "Radiation of Acoustic-Gravitational Waves During Motion of Meteors in the Atmosphere"]

[Abstract] A study was made of the low-frequency pulsed radiation of internal and infrasonic waves during the supersonic motion of meteor bodies in the earth's atmosphere. It is shown that meteors with great initial masses and velocities effectively excite these waves as a result of a great release of energy during combustion. The article gives estimates of the amplitudes of disturbance of pressure at the earth's surface and the electron concentration in the ionosphere during the flight of a meteor at altitudes 50-120 km. A study was also made of the distribution of radiant energy in the low-frequency wave spectrum. Expressions are also derived for the total radiant energy of internal and infrasonic waves.

[53]

TURBOPAUSE AS A SPECIFIC ZONE IN UPPER ATMOSPHERE

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 3, 1977 pp 39-44

[Article by O. O. Ovezgel'dyyev and L. P. Korsunova, Physical-Technical Institute Academy of Sciences Turkmen SSR, "The Turbopause as a Specific Zone in the Upper Atmosphere. I"]

[Abstract] The results of studies of the wind regime in the lower thermosphere make it possible to conclude that the turbopause of the earth's atmosphere in dynamic respects is manifested as a zone of strong wind shears. However, it is impossible to say that above the turbopause atmospheric pressure has a purely laminar character because one cannot preclude the possibility of existence of an irregular wind velocity component of nonturbulent origin or pseudoturbulent motion. Evidently, it is more correct to assume that above the turbopause well-developed turbulent motion is absent and the transfer process is determined by a nonturbulent mechanism. Below the turbopause there is well-developed turbulent motion and turbulent transfer plays a definite role in the redistribution of thermal energy and neutral components in the atmosphere.

[52]

PHASE METHOD STUDY OF ELECTRON CONCENTRATION IN IONOSPHERE

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 3, 1977 pp 45-48

[Article by S. F. Mirkotan and Z. K. Shibayev, Physics Faculty, Moscow State University, "Investigation of Electron Concentration in the Ionosphere by the Phase Method"]

[Abstract] The paper presents the principal results of an experimental investigation of rapid (with a period of about tens of seconds) and small (with respect to dispersion) fluctuations of electron concentration ΔN_m and δN_m at the level of the layer maximum (not resolved by the altitudinal-frequency characteristics method). The observations were made with an ionospheric apparatus with scanning of the carrier frequency, constituting a special receiving-transmitting phase-measuring ionospheric station (pulse power 20 KW, range 1-17 MHz). It was possible to obtain detailed segments of the phase-frequency characteristics and their temporal variability. The critical frequency was measured at an interval of 1-30 sec and an error no greater than 1 KHz. A method was developed for precise measurement of the instantaneous f_{cr} values. The duration of the observations was 3-6 minutes. The article describes a typical example of a record of rapid fluctuations of the critical frequencies and corresponding fluctuations of the electron concentration at the layer maximum. It was found that the critical frequencies f_{cr} (and accordingly, N_m) are characterized not only by the well-known slow variations (diurnal, hourly, and also caused by large-scale inhomogeneities with a period of 15-30 minutes), but also experience rapid random changes with a quasiperiod from 30 to 120 sec with a mean value of the period $T = 58$ sec. For a model of a turbulent "frozen-in" ionospheric layer subject to regular drift at a velocity customary for F_2 , the cited temporal fluctuations must be related to inhomogeneities with a spatial quasiperiod of 3-12 km, averaging 5.8 km.

[52]

VI. MISCELLANEOUS

News

COMMENTS ON THE NEED FOR ANTARCTIC RESEARCH

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Aug 77 p 4

[Article by O. Popov, "Why the Antarctic?"]

[Abstract] Since February more than 200 men, participants on the 22d Soviet Antarctic Expedition, have been at work at six stations on the sixth continent. The treasures of Antarctica are well worth the efforts of mankind. One of the latest proposals for exploiting these riches has been advanced by Saudi Arabia: tow icebergs from Antarctica for supplying water to the desert wastes of the Middle East. Australian specialists already had advanced the idea that a pipeline on the ocean floor could supply water to the desert wastes of Central Australia. There has been talk about exploiting the mineral resources of the moon, but the vast and diversified resources of Antarctica still go unexploited. For example, it is estimated that the coal deposits of Antarctica surpass those of all the other continents taken together. One iron ore deposit alone occupies an area of 10,000 square kilometers. Nickel, lead, manganese, molybdenum: these are but a few of the ores present in vast quantities. But at the moment no expedition has ever succeeded in drilling through the 4-km ice thickness. Nevertheless, scientists feel that mines and open pits are entirely feasible. Vertical shafts would have to be sunk in places where the ice mantle is motionless. A very expensive proposition, without even thinking of land and ocean transport, but then who knows what the needs of man will be a hundred years from now? But the Antarctic region has vast food resources as well. The southern waters have a far greater abundance of plankton, vegetation, fish and sea animals than the waters at corresponding latitudes in the northern hemisphere. This has been demonstrated by research carried out by underwater divers of the Leningrad Zoological Institute USSR Academy of Sciences. All year round they have dived beneath the shore ice. During the first season alone the aqualung divers made over 200 dives, recovered a mass of samples of underwater flora and fauna and took hundreds of very valuable photographs. They demonstrated that the population of the Antarctic floor greatly resembles the floor of tropical

seas. The opportunities for artificial creation of "farms" for plants and animals are tremendous. Soviet specialists at this time are making aerial surveys for the compilation of more precise maps and for geological reconnaissance. A large team of experienced drillers is helping in geophysical, glaciological, microbiological and geological studies. Under the "Polar Experiment - South" program specialists are studying the interaction of the ocean, Antarctic ice and the atmosphere in the expanse between the shores of Antarctica and the shores of Australia. This is the "weather kitchen" of the southern atmosphere. A borehole is being drilled in the ice in the neighborhood of the south pole. The objective is to recover a deep ice core and study its content of microorganisms. Such experiments have already been carried out and have given surprising results. A distance of 207 m was drilled and 500 samples were taken. The most ancient of the living bacteria were extracted from a depth of 197 m. The age of this sample was estimated at 8,500 years. It is hoped that the new system of thermodrilling proposed by V. A. Morev will help in drilling boreholes to greater depths than was possible before.

[39]

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